| L Number | Hits | Search Text | DB | Time stamp |
|---|---|---|---|---|
| 11 | 810 | inductors and (AC with coupling) | USPAT; US-PGPUB | 2004/09/14 17:53 |
| 12 | 676 | (inductors and (AC with coupling)) and @ad<20011128 | USPAT; US-PGPUB | 2004/09/14 17:35 |
| 13 | 39 | ((inductors and (AC with coupling)) and @ad<20011128) and ((plural or plurality or array) with inductors) | USPAT; US-PGPUB | 2004/09/14 17:38 |
| 14 | 637 | ((inductors and (AC with coupling)) and @ad<20011128) not (((inductors and (AC with coupling)) and @ad<20011128) and ((plural or plurality or array) with inductors)) | USPAT; US-PGPUB | 2004/09/14 17:44 |
| 15 | 13 | inductors and (AC with coupling) | EPO; JPO; DERWENT; IBM_TDB | 2004/09/14 17:52 |
| 16 | 1 | 257/676,678,684,724,777,778.ccls. and inductors and (AC with coupling) | USPAT; US-PGPUB | 2004/09/14 17:55 |
| 17 | 1 | 438/106-109.ccls. and inductors and (AC with coupling) | USPAT; US-PGPUB | 2004/09/14 17:56 |

US-PAT-NO: 6030877

DOCUMENT-IDENTIFIER: US 6030877 A

TITLE: Electroless gold plating method for forming inductor structures

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Brief Summary Text - BSTX (5):
The communications field requires high frequency products for portable applications in the RF and microwave frequency ranges. The integrated circuits that help meet tasks need generally require passive components such as capacitors and **inductors** for tuning, LC tanks, **AC coupling,** impedance matching and filtering requirements. However, with regard to **inductors,** integrating **inductors** on the same substrate with active and/or passive components has been problematic. Moreover, the inductor resistance must be reduced to improve device performance.

Brief Summary Text - BSTX (6):
Gold is an attractive material from which to fabricate inductor elements. However, conventional methods of forming gold **inductors,** such as electrolytic plating and sputtering, have not been successful. The processes are costly and often involve harmful/detrimental etch steps. There is a need for improved methods to form **inductors** that have lower resistance, lower costs, and less process etch steps.

Brief Summary Text - BSTX (7):
The importance of overcoming the various deficiencies

noted above is evidenced by the extensive technological development directed to the subject, as documented by the relevant patent and technical literature. The closest and apparently more relevant technical developments in the patent literature can be gleaned by considering U.S. Pat. No. 5,266,519(Iwanoto) which shows a method of forming a metal conductor using a selective deposition of Gold. U.S. Pat. No. 5,308,796(Feldman) shows a method of selectively depositing Cu over a metal silicide. U.S. Pat. No. 3,993,808(Inaba et al.) shows a method of electroless plating Gold on Tungsten. U.S. Pat. No. 5,242,861(Inaba) show a method of forming a multi-layered structure having a gold under layer. U.S. Pat. No. 5,272,111(Kosaki) shows a method of forming a contact having a Au deposited on a Ni--P layer. U.S. Pat. No. 5,478,773(Dow) shows a Copper inductor. Burghartz et al., "High -Q **inductors** in Standard Silicon Interconnect Technology and its Application to an Integrated RF Power Amplifier", IEDM 95, pp. 1015 to 1017, discussed **inductors**. Yamaguchi et al., "Characteristics And Analysis Of A Thin Film Inductor With Closed Magnetic Circuit Structure", IEEE transaction on Magnetic, Vol. 82, No. 5, September 1992, pp. 3015 to 3017 discusses RF sputtering Ni--FE--MO--Cu permalloy films.

Brief Summary Text - BSTX (57):

The three embodiments of the present invention provide a low resistance gold inductor 40 46. The electroless processes, of the invention lower the inductor element resistance. The methods selectively form gold **inductors** so that expensive and detrimental etch steps are not required. Moreover, the gold inductor is more resistive to corrosive environments. Also, the gold inductor

can be operated a considerably high current densities than traditional Al
alloys without suffering from electromigration effects. This is because Au has
an activation energy of self diffusion in the range of 0.85 to 1.0 eV. The
activation energy of self diffusion indicates the upper limit of the current
density allowable before breakdown or electromigration effects. In comparison,
Aluminum has an activation energy value of about 0.5 eV.

Drawing Description Text - DRTX (4):
FIG. 2A is a top down view of a preferred shape/pattern of the single metal
layer inductor element of the present invention. FIG. 2a also represents the
**inductors** formed in the second and third embodiments.

Drawing Description Text - DRTX (5):
FIG. 2B is a top down view of a preferred shape/pattern of the multilayer
inductor element of the present invention. FIG. 2B shows the first inductor
46, core metal layer 54 and second inductor 46A. FIG. 2B also represents the
**inductors** formed in the second and third embodiments.

Detailed Description Text - DETX (57):
The three embodiments of the present invention provide a low resistance gold
inductor. The electroless processes of the invention lower the inductor
element resistance. The methods selectively form gold **inductors** so that
expensive and detrimental etch steps are not required. Moreover, the gold
inductor is more resistive to corrosive environments. Also, the gold inductor
can be operated a considerably high current densities than traditional Al
alloys without suffering from electromigration effects. The gold inductor has
an activation energy of self diffusion in the range of 0.85 to 1.0 eV. This

activation energy of the gold inductor is a benefit due to the self diffusion
of Au is higher than Al.

Other Reference Publication - ©REF (1):
Burghartz et al, "High-Q **inductors** in Standard Silicon Interconnect
Technology and Its Application to an Integrated RF Power Amplifier" IEDM '95
p1015-1017.